

## Ethnomedical and Ethnopharmacological Study of Plants Used For Potential Treatments of Diabetes and Arterial Hypertension by Indigenous People in Three Phytogeographic Regions of Cameroon

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### Abstract

Diabetes and arterial hypertension, two of the most important multifactorial, metabolic and chronic diseases, with fatal complications, remains two public health problems worldwide. So far, no studies have investigated the ethnomedical surveys to record plants used for both treatments of diabetes and arterial hypertension and their common derived manifestations. The objective of the present study was to collect and document information on herbal remedies traditionally used for the treatment of diabetes and arterial hypertension and their signs, symptoms and complications in Cameroon. Detailed botanical prospection and ethnopharmacological thorough preparation was conducted nearby 1131 interviewers from 58 tribes of Cameroon, in a random distribution developed in [1]. In total, 71 species of plants belonging to 58 genera in 30 families were reported to be used in the preparation of the herbal remedies. Plants that include *Azadirachta indica*, *Momordica charantia*, *Phyllanthus amarus*, *Phyllanthus niruri*, *Laportea ovalifolia*, *Ceiba pentandra*, *Allium cepa*, *Persea americana* and *Catharanthus roseus* were revealed interesting in the potential management of diabetes and arterial hypertension. Many plants like *Iringia grandifolia*, *Copaifera religiosa* and *Strombosiaopsis tetrandra* are documented for the first time for their uses in the treatment of diabetes and arterial hypertension complications. Eighteen plants species are recognized by some informants in the direct or usual treatment of diabetes and arterial hypertension. The results provide the basis for further preparation of phytodrugs for diabetes and arterial hypertension and their complications.

**Keywords:** Indigenous people of Cameroon; Ethnomedical and Ethnopharmacological study; Potential treatments; Diabetes and hypertension; Symptoms and complications; Diabetes with arterial hypertension; Symptomatic treatment; Indigenous knowledge; Cameroon

### Introduction

Hypertension affects approximately 70% of patients with type 2 diabetes, 30% of patients with type 1 diabetes and it is approximately twice as common in persons with diabetes as in non-diabetics [2]. The prevalence of coexistent hypertension and diabetes substantially varies across different socio-cultural and racial groups. The overlap between hypertension and diabetes provokes the risk of vascular complications in this population, and together both pathologies predispose to chronic nephropathy, retinopathy and sexual dysfunction [3]. Diabetes mellitus is an independent risk factor for coronary artery disease, and the risk is markedly increased when hypertension is present. The incidence and prevalence of type 2 diabetes are increasing (Public Health Agency of Canada 2009-2010 to 2014-2015). The total number of people with diabetes will rise from 171 million in 2000 to 366 million by 2030 [4]. The number of adults with hypertension is predicted to increase by 60% to a total of 1.56 billion people by 2025 [5].

Diabetic nephropathy is the commonest cause of hypertension in patients with type 1 diabetes. Patients with type 2 diabetes can develop renal disease, but hypertension commonly occurs without abnormal renal function and is often associated with central obesity. Insulin resistance and diabetes can precipitate hypertension by stimulating the sympathetic nervous system and the renin-angiotensin system, and promoting sodium retention. Diabetes is also associated with increased proliferation of vascular smooth muscle cells. High blood glucose and elevated blood pressure can impair vascular endothelial cells, leading to increased oxidative stress. Patients with diabetes also have increased vascular reactivity. Therefore diabetes and arterial hypertension are

currently two chronic un-tidyness associated in elderly persons. Their real causes are not perfectly known. They are linked to our genetic patrimony, to our life-style that includes sedentary, excessive and unbalanced alimentation, consumption of toxic agents like alcohol, tobacco, and certain drugs. The characteristics of these pathologies are a glycosuria (presence of glucose in the urine) persisting with an hyperglycemia (excessive glucose concentration in the blood) for diabetes and the systolic blood pressure values superior or equal to 140 mmHg for and diastolic blood pressure values superior or equal to 90 mmHg [6] for arterial hypertension. These parameters which are easily highlighted in occidental medicine for diagnosing diabetics with hypertensive patients are failed to appreciate in traditional medicine. However, in the indirect way, the traditional healers, mostly of the hinterland, control these diseases by treating rather their signs, symptoms and/or some complications. So in this present study we focused a particular interest on plants used in the treatment of common signs, symptoms and complications of these two pathologies.

The diabetic with arterial hypertension patients' monthly cost of treatment is 60500F cfa in case of non-complicated arterial hypertension

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**Received:** July 27, 2016; **Accepted:** July 29, 2016; **Published:** July 31, 2016

**Citation:** Nole T, Lionel TDW, Cedrix TFS, Gabriel AA (2016) Ethnomedical and Ethnopharmacological Study of Plants Used For Potential Treatments of Diabetes and Arterial Hypertension by Indigenous People in Three Phytogeographic Regions of Cameroon. Diabetes Case Rep 1:110. doi: [10.4172/2572-5629.1000110](https://doi.org/10.4172/2572-5629.1000110)

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and/or diabetes (Professor Nouedoui, personal communication). The diet increases more the financial charges of patients. Certain combinations of diabetes with antihypertensive treatments, composed from pharmaceutical products and their cost like Hexen 50 (13 860 Fcfa), Lodoz (10 415 Fcfa) and insulatard HM (14 525 Fcfa), Actrapid HM (14 510 Fcfa), etc. are rare in rural zones or expensive for patients. Then the difficulties to get drugs hold up the treatment and very soon can appear the redoubtable complications like: left ventricular hypertrophy, occlusion of coronary arteries (infarctus) and in the brain (stroke), kidney insufficiency. These complications render difficult and unaffordable the treatment for most diabetics with hypertension.

In response to the global health challenge, the WHO expert Committees on diabetes and on arterial hypertension that recommended further evaluation of the folkloric methods of managing the two diseases, we had identified and evaluated their treatment from their signs, symptoms and complications in traditional medicine; because of high mortality and morbidity arising from their attendant complications and the draw-backs associated with the use of conventional hypoglycemic and hypotensive drugs [7,8].

In Cameroon several diabetic with hypertensive patients used plants of familial traditional medicine and/or by consulting the traditional healers in surreptitious because of their social exclusion after the appearance of severe complications that include numbness of feet, blindness, urinary incontinence, edema and skin infection. Numerous questions can be addressed for such treatments. Is the diagnostic in traditional medicine right? Do the diabetic with hypertension patients discern really their health? Do the traditional healers recognize the commons signs, symptoms and complications of the two diseases? Do the plants that are used in the treatment of these manifestations able to treat the diabetic with hypertension patients? To response to all these questions we carry out an ethnomedical and an ethnobotanical survey that include patients and traditional healers living in Cameroun.

## Material and Methods

The ethnomedical and ethnopharmacological survey was carried out beside 1131 informants distributed according to [1] and mainly constituted by traditional healers, elderly persons and diabetic with arterial hypertension patients. These informants were divided into groups. The first group was constituted by informants who don't know diabetes and arterial hypertension, but who treat them through their signs, symptoms and complications that were identified with the aid of a medical doctor. The second group was constituted by informants who know diabetes and arterial hypertension. Early common signs or symptoms like sexual weakness, headache, obesity, excessive transpiration, etc. were recorded. Some of common complications recorded are: cardiac problems (arteriosclerosis), chronic *kidney injury*, fungi skin infections, retinopathy, etc.

The survey was carried out in three main phytogeographic regions of Cameroon [7,9] that include coastal humid rain forests; continental humid rain forests and Soudano-Zambezi and Guinean savannahs [7] (Figure 1). These regions correspond respectively to littoral plain: dense humid coastal forests domain; Cameroonian south plateau: dense humid continental forests domain and High and low lands: dry and humid savannahs domain.

Samples of plants used to treat diabetes and arterial hypertension and their interconnected complications were harvested in collaboration with informants and identified and/or confirmed in National Herbarium of Cameroon.

## Ethnopharmacological preparation

The ethnopharmacological preparation of recipes derived from identified plants were described in detail with the precision of the specific part (s) of plant (s), fresh or dry, animal parts used and/or mineral combined with the principal plant for medicine; admixtures-

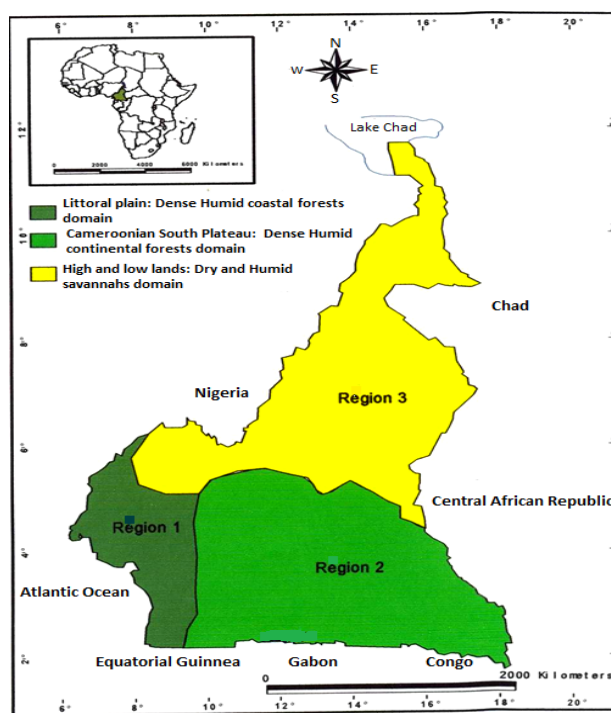


Figure 1: Principal phytogeographic areas of Cameroon [7] Identification of recorded plants.

taking simultaneously or sequentially, quantity of vegetal material (s) used, quantity of water or other solvent that include palm vine in forest regions and raphia vine in western highland regions, oil, palm kennel oil; temperature for decoction and time of preparation. The ethnomedical administration of the preparations were also described with the precision of the method of administration that include: oral, topical, intrarectal routes and scarification; amount of medicine used per dose, per day, number of days, undesirable effect (s), secondary effect (s) and associated diets [7,10]. The botanical, ethnopharmacological and the ethnomedical data collection field form was used to collect data. The verification of both antidiabetic and antihypertensive properties and plant mechanisms of action were assessed through bibliography research.

### Methodology of literature research

The glycemia and blood pressure regulation is linked to a great number of plants with different mechanisms related to types of diabetes and arterial hypertension and their causes.

### General assumption

A plant which reduces the glycemia and the blood pressure can avoid the manifestations of diabetes and arterial hypertension and then retards the development and the progression of their degenerated complications. This plant may have hypoglycemic and hypotensive compound(s) responsible of anti-diabetic and antihypertensive properties.

### Specific assumptions

A plant that avoids at least a combination of one arterial hypertension' cause and one diabetes' cause, can prevent diabetes and arterial hypertension.

#### There are eight specific assumptions:

1. A plant that avoids both diabetic and hypertensive genetic genes' expression, cause of diabetes or hypertension can prevent these diseases
2. A plant that reduce the rigidity of blood vessels can regulate arterial hypertension
3. A plant which presents the mechanism by which  $\beta$ -blockers appear to reduce central blood pressure to a lesser extent than brachial blood pressure can reduce the arterial hypertension
4. A plant that can correct the anomalies of system renin-angiotensin II-aldosterone, can prevent arterial hypertensions
5. A plant which renders sensible the muscle tissues to insulin, could correct insulin resistance and facilitate the passage of glucose into cells, for metabolism;
6. A plant that acts in the level of tissues like injected insulin can alleviate the diabetic
7. A plant that stimulates  $\beta$ -cells to produce more insulin can relieve diabetic type 2 patients. But this effect becomes impossible, if the islet cells by the time are death due by over functioning.
8. A plant that avoids intestinal absorption of glucose can reduce glycemia and alleviate diabetic patients.

These assumptions are defined for a better orientation of literature pharmacological research on recorded plants. This research helps for detecting different hypoglycemic and hypertensive properties and safety or non-toxicity of these plants [7].

### Statistical Analysis

The informants that include group 1 constituted of informants who know diabetes and arterial hypertension and group 2 constituted of informants who don't know diabetes and arterial hypertension but treat them through their signs, symptoms and complications; were compared. The different types of recipes were and two by two compared. The number of plants recorded in each main phytogeography was also two by two compared. Statistical differences were assessed using standard protocol as described in "Statistical Methods in Biology" [11,12].

### Results

#### Distribution of the recorded results

In total, 71 species of plants belonging to 57 genera and 30 families were reported to be used in the preparation of the herbal remedies. Twenty (20) of them were recorded in the coastal humid rain forests, 30 in the continental humid rain forests and 21 in the Guinean-Soudano-Zambesian savannas. Many common signs, symptoms and complications of diabetes and arterial hypertension and correspondent plant species for their treatment were recorded.

#### Ethnomedical study and medicinal important properties of recorded plants

Protective role of medicinal plants on the onset of diabetes and arterial hypertension Anti-obesity plants can regulate the overweight sometime responsible of type 2 diabetes and arterial hypertension. Therefore, these plants can reduce the risk of occurrence of these diseases.

#### Recorded medicinal plants usually used in traditional medicine to treat diabetes and arterial hypertension common signs, symptoms and complications

Each of these plants is used by traditional healers to treat the following common signs, symptoms and/or complications of diabetes and arterial hypertension, presented bellow in brackets. These plants are distributed in function of the three main phytogeographic zones of Cameroon.

##### Plants recorded in the coastal dense humid rain forests:

1. *Drypetes staudtii Euphorbiaceae* (sexual weakness, muscle pain and lombalgo).
2. *Bridelia micrantha Phyllanthaceae* (muscle pain, numbness of feet, insomnia, physical and sexual weakness).
3. *Carapa procera Meliaceae* (muscle pain, insomnia, kidney injury, sexual weakness, chest pain and lombalgo).
4. *Xylopia aethiopica Annonaceae* (sexual and physical weakness, obesity and muscle pain).
5. *Glossocalyx brevipes Monimiaceae* (fuzzy vision, kidney injury, numbness of feet, muscle pain, fecal and urinary incontinency).
6. *Allanblackia floribunda Clusiaceae* (sexual and physical weakness, muscle pain, cardiac problems).
7. *Pteleopsis hyloidendron Annonaceae* (cardiac problems, kidney injury and generalized weakness).
8. *Staudtia kamerounensis Myristicaceae* (fungi infections, general weakness and muscle pain).

9. *Treculia obovoidea* Moraceae (generalized pain, lumbalgia and heart failure).
10. *Andira inermis* (W. Wright) DC) Fabaceae-Papionoideae (generalized weakness, gangrenes, and sexual weakness).
11. *Entandrophragma cylindricum* Meliaceae (Sprague) Sprague (urinary and fecal incontinency, lumbalگو, generalized weakness and fuzzy vision).
12. *Nauclea diderrichii*: Rubiaceae (De Wild. & Th. Dur.) Merrill (cardiac problems, dysuria, physical and sexual asthnia).
13. *Irvingia grandifolia* (Engl.) Engl. Irvingiaceae (kidney injury, cardiac problems, lumbalگو and weakness sexual).
14. *Antrocaryon klaineianum* Pierre: Anacardiaceae (muscle pain, physical asthnia and lumbalگو).
15. *Klainedoxa gabonensis* Irvingiaceae (physical asthnia, muscle pain, cramps, funga infections and numbness feet).
16. *Irvingia gabonensis*: Irvingiaceae (sexual weakness, back pain, muscle pain, chest pain, nasal bleeding and numbness).
17. *Saccoglottis gabonensis* Baill. Urb: Humiriaceae (fungi infections, insomnia, cardiac and renal deficiency).
18. *Stipularia africana* Rubiaceae (fungi infections, insomnia, nervosity, cardiac palpitations and renal deficiency).
19. *Persea aericana* L. Lauraceae (lumbalگو, fall of visual shrewdness and vertigo).
20. *Catharanthus roseus* L.; Apocynaceae (lumbalگو and fall of visual shrewdness).
- Plants recorded in the continental dense humid rain forests:**
21. *Antrocaryon klaineianum micraster* A. Chev. Anacardiaceae (insomnia, nervosity, cardiac palpitations, diabetes and fall of visual shrewdness).
22. *Albizia zygia* (DC) Macbr. Mimosaceae (numbness of feet, gangrene, physical and sexual asthnia, numbness of feet, muscle pain, kidney and cardiac deficiency).
23. *Lovoa trichiloides* Harms: Meliaceae (lumbalگو, generalized and sexual weakness).
24. *Hyloidendron gabunense* Taub: Fabaceae-Caesalpinoides (blurred vision, cardiac and renal problems).
25. *Barteria fistulosa* Mast. Passifloraceae (insomnia, lumbalگو, kidney injury, muscle pain).
26. *Ceiba pentandra* (L.) Gaertn: Bombacaceae (cardiac and renal deficiency, generalized weakness, insomnia, stress and edema).
27. *Fernandoa adolfi-friderici* (Gilg and Mildbr.) H. Bignoniaceae (back pain, physical asthenia, muscle pain and fuzzy vision).
28. *Albizia ferruginea* (Guill. & Perr.) Benth. Fabaceae-Mimosoideae (muscle pain, sexual weakness and gangrene).
29. *Zanthoxylum heitzii* Ehoarn Bidault: Rutaceae (palpitations, numbness of feet and
30. *Allanblackia gabonensis* Oliv: Clusiaceae (sexual weakness, physical asthenia and lumbalگو)
31. *Sterculia tragantha* (lumbalگو, hematuria and generalized weakness).
32. *Zanthoxylum tessmannii* Engl. Rutaceae (cardiac and kidney problems, physical and sexual weakness).
33. *Ficus exasperata* Benth; Moraceae (hypertension, physical and sexual asthnia, muscle pain, loss of appetite).
34. *Khaya ivorensis* A. Chev. Meliaceae (chest pain, visual, cardiac and kidney problems).
35. *Ipomoea mauritiana* Jacquin Convolvulaceae (obesity, muscle and sexual weakness).
36. *Mallothus oppositifolius* (Geisel.) Müll. Arg (Euphorbiaceae) (rebellious wounds, blurred vision, generalized weakness and sexual asthenia).
37. *Ricinodendron heudelotii* (Baill) Pierre ex Pax. (Euphorbiaceae) (kidney problems, rebellious wounds and muscle pain).
38. *Desbordesia glaucescens* Engl. Tiegh (lumbalگو, kidney problems, generalized weakness, fecal and urinary incontinency).
39. *Cylicodiscus gabunensis* Harm (numbness of feet, muscle pain and fungi infections).
40. *Momordica foetida* L. Cucurbiataceae (muscle pain, numbness of feet and lumbalگو).
41. *Celtis tessmannii* Rendle Ulmaceae (gangrene, generalized and sexual weakness, insomnia, nervosity and muscle pain).
42. *Entandrophragma candollei* Harms Meliaceae (back pain, muscle pain, fecal incontinency and lumbalگو).
43. *Entandrophragma utile* (Dawe & Sprague) Sprague Meliaceae (back pain, kidney injury and palpitations).
44. *Hexalobus crispiflorus* A. Rich. Annonaceae (kidney injury and heart failure, lumbalگو).
45. *Plagiostyles africana* Euphorbiaceae (Müll. Arg.) Prain (chest angina, asthenia physical and sexual, kidney and cardiac problems).
46. *Pterocarpus soyauxii* Fabaceae-Papilioideae (physical asthenia, muscle atrophy, painful urine and insomnia)
47. *Copaifera religiosa* J. Léonard Fabaceae-Mimosoideae (kidney and muscle pain, insomnia and dysuria).
48. *Strombosiopis tetrandra* vernacular names: *Edipmbazoa* (Boulou); *Bosiko* (Baka) Olacaceae (sexual weakness, kidney pain, insomnia and cardiac troubles).
49. *Strombosia pustulata* Olacaceae (muscle pain and kidney pain).
50. *Anonidium mannii* (Oliv.) Engl. & Diels Annonaceae (hematuria, pyuria, burn urine, lumbalگو, numbness of limbs).
- Plants recorded in Guinean and Soudano-Zambesian savannas:**
51. *Anacardium occidentale* L. Anacardiaceae (sexual weakness, muscle and generalized pain).
52. *Kigelia africana* (lumbalگو and kidney pain).
53. *Azadirachta indica* L. Meliaceae (insomnia, muscle pain, vertigo, physical asthenia, lumbalگو and cramps)
54. *Momordica charantia* L. Cucurbiataceae (physical asthenia, muscle pain, abundant urine and cramps).
55. *Sarcocephalus latifolius* (Sm.) Bruce Rubiaceae associated

to *Vernonia ambigua* (gangrene, funga infections, muscle pain and insomnia)

56. *Cleome ciliata* Schum. & Thonn. *Capparaceae* (rebellious wounds, blurred vision, cardiac and kidney deficiency).

57. *Tapinanthus globiferus* (A. Rich.) *Loranthaceae* Tiegh (cardiac problems, muscle pain, sexual weakness, anxiety and insomnia).

58. *Bridelia speciosa* Mull. Arg. *Phyllanthaceae* (vertigo, sexual weakness, muscle pain, numbness of feet, insomnia and kidney injury).

59. *Eclipta prostrata* L. *Asteraceae* (brun urine, lombalگو, muscle pain and fungi infections).

60. *Piliostigma thonningii* (Schumach.) Milne-Redh *Fabaceae-Caesalpinioideae* (blurred vision and gangrene).

61. *Cyathula prostrata* L. *Asteraceae* (blurred vision, physical and sexual asthenia).

62. *Cucumis metuliferus* (Schrad.) E. H. Mey. *Cucurbitaceae* (sexual weakness, physical asthenia, muscle pain).

63. *Crossopterys febrifuga* Afzel. Benth. *Rubiaceae* (nocturnal diarrhea, gangrene, kidney and cardiac deficiency, chest angina and anxiety).

64-*Allium cepa* L. *Alliaceae* (arteriosclerosis, hemorrhagic vascular cerebral accidents)

65-*Mucuna pruriens* (L.) DC (nocturnal diarrhea, kidney and cardiac deficiency and anxiety)

66-*Phyllanthus niruri* L. *Phyllanthaceae* (blurred vision and physical and sexual asthenia)

67-*Phyllanthus amarus* L. *Phyllanthaceae* (blurred vision physical and sexual weakness)

68-*Laportea ovalifolia* (Schumach. & Thonn.) *Urticaceae* Chew (kidney and cardiac deficiency and anxiety)

69-*Aloe buettneri* L; *Aloaceae* (arteriosclerosis and hemorrhagic stroke)

70-*Aloe barteri* Barker *Phyllanthaceae* (arteriosclerosis, hemorrhagic stroke)

71-*Vernonia glabra* (Steetz) Vatke *Asteraceae* (arteriosclerosis, hemorrhagic vascular cerebral accidents)

## Description of recipes

Four types of recipes were recorded during the survey.

### Usual or direct recipes used by the followed up diabetic with arterial hypertension patients (type 1)

1-*Mucuna pruriens* vercular manes and dialects: *Meko* sock (Yemba) Boil 0.2 g of seeds powder per kg of the body weight in 250 ml. Filter and drink the filtrate; repeat the operation times per day.

2-*Phyllanthus niruri*: vercular manes and dialects: *Galalouba* (Douala), *Ekabou* (Ewondo) Macerate 1 g of aerial parts per kg of the body weight, in 2 liters of water, for 2 h. Drink 250 ml of filtrate 3 times per day. The filtrate also serves as laxative with higher doses.

3-*Phyllanthus amarus* vercular manes and dialects *Galalouba* (Douala), *Ekabou* (Ewondo) Macerate 1 g of aerial parts per kg of body weight, in 2 liters of water, for 2 h. Drink 250 ml of filtrate 3 times per day. The filtrate also serves as laxative with higher doses.

4-*Laportea ovalifolia* vernacular names and dialects: *Tololi*, *Itoil* (Oroko), *Sasa kola* (Bassa), *Sasangulu* (Pygmées), *Kinhiemou* (Widekam), *Kinshei* (Banso), *Sisie* (Bamiléké), *Dandy* (Bagweri) Boil 100 g of aerial parts in 6 l of water, for 15 min. Drink 250 ml of decoction, 3 times per day controlling the *glycemia*.

5-*Aloe buettneri* vernacular names and dialects: *Ladieheu* (Féfé, Haut-Nkam), *Lélang Tséwang* (Bamiléké), *Lahridah* (Bassa); *Nchahsame* (Bandjoun), *Mavoh* (Nso), *Zabonko*, *Zabon dafi* (Ffulde) Macerate 200 g of leaves, in 2 liters of water. Drink deliberately the filtrate controlling the *glycemia* and the blood pressure.

6-*Aloe barteri* vernacular names and dialects: *Niate* (Bassa), *Lèkôt* (Medumba, Ndé) Macerate 200 g of leaves, in 2 liters of water. Drink deliberately the filtrate controlling the *glycemia* and the blood pressure.

7-*Vernonia glabra* vernacular names and dialects: *Anfûgsa* (Kom) Clean and cut 100 g of rhizome, add to that 3 liters of water. Maintain in ebullition, for 30 min. Filter and drink 250 ml of filtrate, 4 times per day.

### Suspected or indirect recipes used by the traditional healers to treat suspected or indirect diabetic with arterial hypertension patients (type 2)

8- *Allium cepa*: Infuse 200 g cut into small slice, in 2 liters of water. Drink 250 ml of infusion every 6 h.

9- *Catharanthus roseus*: Infuse 40 g of leaves and 40 g of fresh root in 1 liter of water, for 4 h. Drink 250 ml of infusion, 3 times daily.

10- *Celtis tessmannii* vernacular names and dialects: *Kakala*, *Tékélé* (Baka), *Odou* (Ewondo) Maintain in ebullition a teaspoon of powder of bark in 1 liter of water, reduce the decoction until 750 ml. Drink 250 ml of decoction, 3 times daily.

11- *Irvingia grandifolia* vernacular names and dialects: *Andokazanga* (Eton), *Solia* (Baka) Macerate 100 of truck bark in 2 liters of water; Drink 250 ml of macerate, 2 times per day.

12 -*Copaifera religiosa* vercular name and dialect: *Andzèm* (Fang) Macerate 150 g of stem bark in 3 liters water. Drink orally 250 ml daily.

13- *Strombosiopis tetrandra*: Boil for 25 min, 2.5 liters of water containing 200g of bark. Drink 250 ml of decoction, 2 times daily.

14- *Strombosia pustulata* vernacular names and dialects: *Adjip* (Boulou); *Nfo Mbansua* (Fang); *Bombongo* (Baka) Macerate 150 g of pound bark in 3 liters water, for 12 h; filter, drink 250 ml of filtrate every 6 h.

15- *Tapinanthus globiferus* vernacular names and dialects: *Tsaplà* (Yemba, Menoua) Macerate 3 teaspoons of leaves powder in 2 liters of water for 6h. Filter and drink 230 ml of macerate 3 times per day.

16-*Azadirachta indica*: vernacular names and dialects: *Tsaplà* (Yemba, Menoua) Boil for 40 min, 50 g of stem bark, 50 g of flower and 50 g of root in 4 liters of water. Drink 250 ml of filtrate, 2 times per day, for 4 days.

### Suspected or indirect recipes selected on the base of common signs, symptoms and complications of diabetes and arterial hypertension that they can treat according to informants' indications (type 3)

17-*Drypetes staudtii*: Boil 100 g of bark in 3 liters of water. Drink 250 ml of decoction 3 times daily.

18-*Bridelia micrantha*: Boil 100 g of trunk bark 3 liters of water, for 20 min. Drink 250 ml of decoction, 2 times daily. The juice of root kills worms.

19-*Carapa procera*: Macerate for 6 h, 100 g of seeds in ½ l. Drink 250 ml of macerate morning, mi-day and evening, for 3 days.

20-*Xylopia aethiopica*: Boil for 20 min, 100 g of fruits in 2 liters of water. Drink 250 ml of decoction, 3 times daily. The fruit is an excellent spice.

21-*Glossocalyx brevipes*: The fresh leaves are rub on numbed limbs. Infuse in water 100 g of fresh leaves, then rup the painful muscles with this infuse. Drink 250 ml of infuses, 2 times daily.

22-*Allanblackia floribunda* vernacular names and dialects: *Bom* (Baka) Anyone (Boulou), *Elango matatodo* (Douala) Boil 150 g of bark in 3 liters for water, for 30 min. Drink 250 ml of decoction, 2 times daily.

24-*Momordica charantia* vernacular names and dialects: *Bhghwei* (Nso), *Fegage-fegwe* (Kom), *Lepokenang* (Yemba-Menoua-), *Nji-Ngoue* (Bamena-Ndé), *Mangala, Nyangala* (Douala), *Nzoo-zonang* (Bakossi), *Layel dimel* (Fufuldé), *Nsul lombi* (Bassa) Boil 2 g per Kg body weight of stem, leaves, flower and fruit powder in 2 liters of water. Drink a teaspoon of herbal tea, Drink 300 ml of filtrate 3 times daily. The strong doses are toxic. Pregnant women must avoid taking this preparation (Arvigo and Balick, 1998).

25-*Staudtia kamerounensis* verbacular names and dialects: *Bope bikob* (Bassa), *Bambale* (Douala) *Mbonda* (Ewondo), *Ovos* (Boulou) Prepare an herbal tea with 50 g of seed powder in 1.5 l of hot water, for 20 min. Filter and drink 250 ml of decoction, 3 times par a day. Rup the infested parts of the body with the pulverized seed paste to treat fungal infections.

26-*Treculia obovoidea*: Boil 150 g of bark in 3 liters of water, for 30 min. Take orally 1/2 glass (125 ml), 2 times daily.

27-*Andira inermis* vernacular name and dialect: *Akoug-élé* (Ewondo) Boil 30 g of bark in 1 liter water. Drink 4 teaspoons per day. Sprinkle gangrene with small quantity of bark powder. Strong doses can provoke vomiting, violent purge, delirium.

28-*Entandrophragma cylindricum* vernacular names and dialects: *Njock* (Bassa), *Kanga* (Baka), *Shicha* (Bayangi), *Assié* (Ewondo, Eton) Boil 150 g of trunk bark in 2,5 l water, for 15 min. Drink 250 ml of decoction, 2 times daily.

29-*Nauclea diderrichii* verbacular names and dialects: *Ankondok* (Boulou, Ewondo), *Ntomba* (Baka) Boil 150 g of bark in 3 liters water, for 30 min. Drink 250 ml of decoction orally, 3 times daily.

30-*Antrocaryon klaineinum* vernacular names and dialects: *Angongui, Angonga* (Ewondo, Boulou), *Lingonga* (Bassa) Boil 150 g of bark in 3 liters of water, for 30 min. Drink 250 ml of decoction orally, 3 times daily.

31-*Klainedoxa gabonensis* vernacular names and dialects: *Onua* (Badjoué), *Pekei* (Bangando), *Payo* (Baka); *Njoka* (Douala), *Andok Beti* (Ewondo); *Nsen, Osen* (Ejagham), *Nsine* (Balong), *Ndo'o mefan* (Boulou) Macerate 200 g of pick up long stipules in 2 liters of water. Drink 250 ml of macerate, 2 times daily.

32-*Irvingia gabonensis*: Maintain in ebullition 1.5 liters of water containing 40 g of bark, for 15 min, Drink 115 ml of decoction, 2 times daily.

33-*Stipularia africana*: 100 g of leaves are boiled in 3 liters of water, for 30 min. Drink 250 ml of decoction, 3 times daily.

34-*Saccoglottis gabonensis* vernacular names and dialects: *Eloué, Edoué* (Bassa), *Bidou* (Ewondo), *Bodoua* (Douala) Macerate 150 g of bark in 3 liters water. Drink orally 250 ml of macerate every 6 h.

35-*Albizia zyzia* vernacular name and dialect: *Sene* (Ewondo) macerate 50 g of fresh leaves in 2 liters of water. Drink 250 ml macerate, 2 times daily, for 7 days.

36-*Hyloidendron gabunense* vernacular names and dialects: *Lando* (Pygmées) *Mvanda* (Ewondo), *Lam* (Badjoué), *Alane* (Boulou), *Mbate mbare* (Eton), *Okam* (Ejagham), *Ibeinga beinga* (Oroko) Boil 200 g of trunk bark in 2,5 l of water, for 30 min. Drink 250 ml of decoction, 2 times per day.

37-*Lovoa trichiloides* vernacular names and dialects: *Bibolo* (Boulou, Ewondo), *Wo* (Baka) Boil 100 g of decoction in 2.5 liters of water, for 30 min. Drink 200 ml orally, morning, mi-day and evening, for a week.

38-*Anonidium mannii* vernacular names and dialects: *Bom* (Badjoué), *Ebom* (Ewondo, Boulou, Eton), *Ngwé* (Baka), *Mfonbou Komo* (Kaka) Maintain in ebullition 200 g of trunk bark in 2.5 liters of water. Drink orally 250 ml, 3 times per day, for 7 days.

39-*Fernandoa adolfi-friderici* vernacular names and dialects: *Mbongo* (Baka), *Ndjuewe* (Badjoué), *Edjugongo* (Ewondo, Boulou) Boil for 30 min, 200 g of trunk bark, 2.5 liters of water. Drink 250 ml of decoction, 3 times daily.

40-*Khaya ivorensis* vernacular names and dialects: *Ngollon* (Ewondo), *Nzammgila* (Fang) Boil 200g of bark in 4 ml of water, for 30 min. Drink 250 ml, 3 times per day, for 7 days.

41-*Sterculia tragantha* vernacular names and dialects: *Efock afoun, Etoup* (Ewondo) Boil 200 g of bark in 2.5 liters of water, for 30 min. Drink orally, 250 ml of decoction; 2 times per day; for 5 days

42-*Ipomoea mauritiana*: Macerate 200 g of root and starch in 2.5 liters of water. Drink 250 ml of macerate every 6 h.

43-*Mallothus oppositifolius* vernacular names and dialects: *Ofes* (Ewondo) Boil 150 g of fresh leaves in 3 liters of water, for 30 min. Drink 250 ml of decoction, 2 times per day.

44-*Ricinodendron heudelotii* vernacular names and dialects: *Essang* (Boulou), *Essessang* (Ewondo); *Gobobo* (Baka) Boil for 30 min, 200 g of fresh truck bark, in 2.5 liters of water. Drink 230 ml every 6 h, for 7 days.

45-*Desbordesia glaucescens* vernacular names and dialects: *Oman* (Ewondo), *Alep* (Boulou), *Melea* (Baka) Maintain in ebullition 200 g of truck bark in 2.5 liters of water. Drink orally 250 ml of decoction, 3 times per day, for 4 days.

46-*Cylicodiscus gabunensis* vernacular names and dialects: *Bolouma* (Baka); *Doum* (Ewondo) Infuse 250 g of truck bark in 3 liters of water. Drink 12 5ml of filtrate orally, 2 times per day.

47-*Momordica foetida* vernacular names and dialects: *Oyalzom* (Ewondo, Boulou), *Nyabé* (Bassa) Macerate 80 g of fresh leaves in 2 liters of water, then use the filtrate to rup the painful muscles and numbed feet. Drink 250 ml of decoction, 2 times per day, for 7 days.

48-*Hexalobus crispiflorus* vernacular names and dialects: *Evota* (Baka) *Pouta* (Baya) Maintain in ebullition 200 g of truck bark in 3 liters of water, for 7 days.

49-*Plagiostyles africana* vernacular names and dialects: *Esoula* (Fang), *Ngola* (Bassa), *Alomba* (Ewondo) Maintain in ebullition, for 30 min, 200 g of truck bark, in 3 liters of water. Drink 250 ml of filtrate, every 6 h, for 7 days.

50-*Entandrophragma utile* vernacular names and dialects: Timbre (Douala), *Aseng assié* (Ewondo), *Lésé* (Baka), *Koukindjou* (Bassa) Boil 100 g of truck in 2.5 liters water, for 30 min. Drink 250 ml of decoction, morning and evening.

51-*Barteria fistulosa Faambo* (Baka), *Mebenga* (Boulou): Boil for 30 min, 150 g of truck bark in 2,5 l of water. Drink 250 ml of filtrate, 2 times daily.

52-*Pterocarpus soyauxii* vernacular names and dialects: *Mbel* (Ewondo); *Mbe* (Boulou), *Mbélé* (Baka) Maintain in ebullition 250 g of truck bark in 3 liters of water. Drink 250 ml every 6 h, for 7 days.

53-*Allanblackia gabonensis* vernacular names and dialects: *Nsangoma* (Ewondo), *Ayonne* (Bassa), *Anyoe* (Boulou). Macerate 250 g of truck bark in 2 liters of water. Drink 250 ml of macerate, every 4 h.

Both usual (direct) and suspected recipes recorded not used by a given patient or traditional healer (type 4).

54-*Abrus precatorius* vernacular names and dialects: *Nze-zunang* (Bakossi), *Nkwel-nutie* (Bassa), *Bellemi* (Ffulde), *Elog et zebang* (Eton) Grind 100 g of aerial parts. Boil the powder in 2.50 liters of water. Drink orally 250 ml one time per day. The seeds are toxic (3 to 4 seeds can kill a horse [13]).

55-*Zanthoxylum tessmannii* verbacular names and dialects: *Bongo*, *Eyelongo* (Ewondo, Boulou, Eton), *Djou souatomo* (Badjoué) *Pupam* (Mboum), *Bolongo* (Baka) Boil for 30 min 100 of bark in 3 liters of water. Then drink orally 250 ml of decoction, 2 times per day.

56. *Pteleopsis hylo dendron* vernacular names and dialects: *Miole* (Badjoué), *Mobito* (Baka), *Rissiche* (Bassa), *Sikon* (Ewondo, Eton): Boil 200 g of bark in 6 liters of water, for 20 min. Drink 230 ml of decoction, 4 times per day, for 7 days.

57-*Ocimum gratissimum* vernacular names and dialects: *Ndali*, *Lisepo* (Bakoundou), *Mesep* (Ewondo), *Masebi* (Bassa); *Ose-mo-se* (Bakossi) *Nkuwri* (Bangwa), *Mahepo* (Douala), *Ndoundo* (Baya); *Tchâm* (Medumba-Ndé); *Ossim* (Boulou) Boil 100 g of fresh leaves in 3.5 liters of water, for 30 min. Drink 250 ml of filtrate, 3 times per day per, for 7 days.

58- *Zanthoxylum heitzii* vernacular names and dialects: *Bolonais* (Baka), *Bongo* (Ewondo), *Oblong* (Fang), *Djouba* (Badjoué): Boil 100 g of aerial parts in 3 liters of water, for 25 min. Drink 250 ml of filtrate, 3 times per day, for 7 days.

58- *Albizia ferruginea* (Guill. & Perr.) *Benth* vernacular names and dialects: *Sopo*, *Nor* (Baya), *Huit* (Tikar), *Evuvus* (Ewondo), *Elonda* (Baka), *Bosaka* (Oroko), *Ossa'a* (Badjoué), *Fewona* (Kom), *Bitié* (Balong), *Betale*, *Bya*, *Etarom* (Ejaghham) Maintain in ebullition 200 g of bark in 3 liters of water, for 30 min. Drink 250 ml of decoction every 6h, for 7 days.

59-*Hylodendron gabunense*: Boil 200 g of trunk bark in 2.5 liters of water, for 30 min. Drink 250 ml of filtrate, 2 times per day.

60-*Entandrophragma candelei*: Boil 100 g trunk bark in 2.5 liters of water, for 30 min. Drink 250 ml of filtrate, morning and evening.

61-*Kigelia africana*: vernacular names and dialects: *Ngeul* (Yemba,

*Menoua Atem* (Kom), *Maha* (Tokoto), *Girlahi guillahi*, *djirlahi* (Ffuldé), *Nsôt* (Ewondo) Maintain in ebullition 50 g of fresh leaves and 100 g of bark tronç, in 2.5 liters of water. Drink 250 ml of filtrate, 3 times daily.

62-*Cleome ciliata* vernacular names and dialects: *Djatchit* (Medumba, Ndé), *Djatcha* (Nufi, Haut Nkam), *Kayang* (Bafia), *Mbango* (Douala) Macerate 200 g of leaflet stem in 4 liters of water, for 12 h. Drink 250 ml of filtrate, 3 times, for 7 days.

63-*Bridelia speciosa* vernacular names and dialects: *Ncha* (Bamoun) *Nor*, *Sopo* (Baya); *Hui* (Tikar) *Nchat* (Bazou, Ndé) Macerate 200 g of bark in 3 liters of water, for 12 h. Drink 200 ml of macerate, 3 times per day, for 7 day.

64-*Sarcocephalus latifolius* and *Vernonia ambigua*; maintain in ebullition 3 liters of water of water, containing 200 g of *Sarcocephalus latifolius* root and 50 g of *Vernonia ambigua* fresh leaves. Drink 250 ml of filtrate, every 6 h, for 7 days.

65-*Piliostigma thonningii* vernacular names and dialects: *Barkédje* (Ffuldé), *Douma* (Baya), *Pien* (Bamoun), *Lame* (Tikar) Boil for 40 min, 4 liters of water containing 150 g of trunk bark. Drink orally, 250 ml of filtrate, 3 times per day, for 7 days.

66-*Crossopterys febrifuga* vernacular names: *Goup gou* (Baya), *Zat* (Tikar), *Gagnan* (Bamoun), *Trohosohaouaki*, *kashine*, *ahouaki* (Haoussa) Macerate 100 g of fresh leaves in 3 liters of water. Drink 250 ml of filtrate, 2 times per day, for 7 day.

67-*Cucumis metuliferus* vernacular names and dialects: *Lépokouna* (Yemba, Menoua), *Omgbal sou* (Boulou): Peel and cut the fruit in small pieces. Boil them in 3 liters of water. Drink 250 ml of filtrate, 2 in per day, for 5 days.

68-*Anacardium occidentale*: Macerate 50 g of fresh leaves previously crumpled and 50 g of powder in 2 liters of water, add 250 ml of juice of false fruit. Drink 3 times per day, 250 ml of filtrate.

69-*Persea americana* vernacular names and dialects: *Fia* (Ewondo), *Pia* (Yemba-Menoua), *Peye* (Balong), *Eju Okara* (Ejaghham) infuse 1g of young leaves and bud per kg of body weight, in 2 liters of water. Drink 250 ml of filtrate, 3 times per day, for 7 days.

70-*Albizia zygia* vernacular names and dialects: *Pâssi* (Bamoun); *Fekoui* (Baya), *Sat* (Tikar), *Sâa* (Bafoussam, Mifi) Maintain in ebullition 250 g of root bark in 3 liters of water, for 15 min. Drink 250 ml of filtrate, every 6 h, for 5 days.

71-*Cyathula protata*: Boil 150 g of fresh leaves in 3 litres of water. Drink 250 ml of filtrate, 3 times per day.

## Statistical Analysis

### Comparison between different the two types of informants

The number of informants, who don't know diabetes and hypertension, but treat them through its common signs, symptoms and complications and the number of the informants who know diabetes were respectively 911 and 220. If the two types of informants have the same chance to be met during the survey, there is equal probability:  $p = q = \frac{1}{2}$ . The two types of informants form each a binomial distribution. It was about to compare the observed percentage for each type of interviewers to hypothetic value. According to the hypothesis zero (no difference between the two types of informants) the two types of informants have the same chance to appear during the survey. In this case they have the same prevalence in the population. The variance of

Scientific names	Manifestations indicated by the informants	Confirmed manifestations treatments	References
<i>Allium cepa</i>	Insomnia, nervousity, diabetes, cardiac palpitations, and fall of visual shrewdness	Nervosity, heart palpitations, insomnia, diabetes arteriosclerosis and hypertension (fall at 67% of arterial hypertension patients of 25 point the systolic and of 15 points the diastolic rate in mean).	[14]
<i>Anacardium occidentale</i>	Sexual weakness, muscle and generalized pain	Leaves extract and bark are vasodilator, hypoglycemic and hypertensive. They reduce glycemia and blood pressure values still normal level	[13]

**Table 1:** Suspected treatments confirmation of some common signs, symptoms and/or complications of diabetes and arterial hypertension.

this probability is  $V = p \cdot q/n$  with  $n = 1131$  (total number of informants)  $V = 1/2 \times 1/2 / 1131 = 0.000221043$ . Standard error:  $\sqrt{p/n} = 0.014867525$ . The observed values were:

From of informants who don't know diabetes: sample:  $a/n \pm \sqrt{a/n(1-a/n)/n} = 0,194518125 \pm 0,01313$   $a = 220$ .

From informants who know diabetes: sample:  $a/n \pm \sqrt{a/n(1-a/n)/n} = 0,805481874 \pm 0,01005$   $a = 911$

The different observed gap of hypothetic value is:

From informants who do know diabetes: sample:  $0.5000 - 0.194518125 = 0.305481875$  from informants who know diabetes: sample:  $0.805481874 - 0.5000 = 0.305481874$ . By definition, this gap is 2.6 times superior to standard error; we concluded that there was a significant difference between these 2 groups of informants at 95%. The informants who know diabetes were dominant.

### Comparison between the different types of recipes recorded

If the four types of recipes recorded have the same chance to be identified during the survey, there is equal probability:  $p = q = t = k = 1/4$ . The four types of recipes from each a binomial distribution. It was about to compare the observed percentage for each type of recipes, to hypothetic value. According to the hypothesis zero (no difference between the four types of preparation) the four types of recipes have the same chance to appear during the survey. The variance of this probability is  $V = pqt/n$  with  $n = 71$   $V = 1/4 \times 1/4 \times 1/4 \times 1/4/71 = 0.277343$ . Standard error:  $\sqrt{pqt/n} = 0.052734$ , avec  $n = 71$ . The same analysis has permitted to demonstrate that there are a significant difference between types 1 (7 recipes) and type 3 (37 recipes), type 1 (7 recipes) and types 4 (18), type 2 (9 recipes) and type 3 (37 recipes), type 2 (9 recipes) and type 4 (18), type 3 (37) and type 4 (18 recipes). The observed gaps of hypothetic value were 2.5 times superior to Standard error (0.0625). But no significant difference was observed between type 1 (7 recipes) and type 2 (9 recipes).

### Comparison between the numbers of plants recorded in the main phytogeographic areas

Twenty recipes were recorded in the coast humid rain forests, 30 in the continental humid rain forest and 21 in the Soudano-Zambesian Savannahs. The same analysis has permitted to demonstrate that there are a significant difference between types 1 (20 recipes) and type 2 (30 recipes) and type 2 (30 recipes) and types 3 (21). The observed gaps of hypothetic value were 2,5 times superior to Standard error (0.0625). But no significant difference was observed between type 1 (20) type and type 3 (21).

## Discussion

### Potential antidiabetic and antihypertensive plants

Then plant species recorded including *Azadirachta indica*, *Momordica charantia*, *Phyllanthus amarus*, *Phyllanthus niruri*, *Laportea ovalifolia*, *Mucuna pruriens*, *Ceiba pentandra*, *Allium cepa*, *Persea americana* and *Catharanthus roseus*, used to control both

suspected diabetics and arterial hypertensive patients through their common signs, symptoms and complications were revealed interesting by the presence of both hypoglycemic and hypertensive molecules in their chemical constituents. Also the clinical follow up of 10 diabetic with hypertension patients that used these plants in family medication, have given promising results [1]. The Table 1 presents the confirmation of the treatments by these three plants.

Plants diverge much between phytogeographic areas. This is an explication of the significant difference observed between phytogeographic areas. A great number of plants with various families were identified. Different families and habitats of plants recorded can lead to a complexity of constituents with a high probability to identify new active ingredients in the treatment of diabetic and arterial hypertensive patients and/or their signs, symptoms and complications.

## Conclusion

At the end of this work, 71 recipes were described as suspected treatments to diabetic with hypertensive patients. Three of these plants treat some manifestations of the two diseases [13,14]. They can constitute a confirmation of suspected treatments of some common signs, symptoms and complications of diabetes and arterial hypertension. Plants which release the health condition of some followed up diabetic with hypertension patients like *Azadirachta indica*, *Momordica charantia*, *Phyllanthus amarus*, *Phyllanthus niruri*, *Laportea ovalifolia*, *Ceiba pentandra*, *Allium cepa*, *Persea americana* and *Catharanthus roseus* were revealed interesting for the potential management of diabetes and hypertension. Meanwhile the recorded plants needed to be detailed investigated for their chemical and pharmacological properties.

### Acknowledgments

Thanks are expressed to health trade-practioners, householders met in the field which have participated and collaborated to the realization of this work, to Bioresources Development and Conservation Programme-Cameroon (BDPC-C) for the training courses that we receive on field ethnobiology and to Professor Koueke Paul, retired Professor of Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1 for precious help in the comprehension of pharmacological terms.

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